INSTRUCTION MANUAL

For

FFR 230/6

RADIO RECEIVER

INSTRUCTION MANUAL

For

FFR 230/6

RADIO RECEIVER

GALAXY ELECTRONICS INC.
a subsidiary of
HY-GAIN ELECTRONICS CORP.
R.R.3
Lincoln, Nebraska 68505

Order No. 860
PN 800270

Printed in USA

TABLE OF CONTENTS

Section	Description	Page
SECTION 1	INTRODUCTION	1
	1.1 Purpose of Equipment	1
	1.2 Functional Description	1
	1.3 Physical Description	1
SECTION 2	SPECIFICATIONS	1
	2.1 Performance Specifications	1
	2.2 Transistor Compliment	2
	2.3 Integrated Circuit Compliment	2
	2.4 Diode and Fuse Compliment	2
	2.5 Crystal Information	3
SECTION 3	INSTALLATION	3
	3.1 Unpacking	3
	3.2 Rack-Mounted Installation	3
	3.3 Power Requirements	5
	3.4 Antenna Considerations	5
	3.5 Audio Output	5
	3.6 Remote Control	5
	3.7 Alignment	5
SECTION 4	OPERATION	6
	4.1 Explanation of Controls	6
	4.2 Typical Control Settings	6
SECTION 5	THEORY OF OPERATION	7
SECTION 6	PREVENTIVE AND CORRECTIVE MAINTENANCE	11
	6.1 General	11
	6.2 Test Equipment Required	15
	6.3 Alignment	15
	6.4 Trouble Shooting	17
SECTION 7	WARRANTY	22
SECTION 8	PARTS LIST	25

LIST OF ILLUSTRATIONS

Figure	Description	Page
1	Front Panel	4
2	Rear Panel	4
3	Block Diagram	8
4	Top View	10
5	Printed Circuit Boards A101 - RF Amplifier A201 - Balanced Mixer A701 - HF Oscillator A801 - Audio A901 - BFO	12
6	Printed Circuit Boards A301 - 1650 KHz IF A401 - 53 KHz IF A601 - Second Osc/Divider	13
7	Bottom View	14
8	Semiconductor Basing Diagram	21

CIRCUIT DIAGRAMS

Module Interconnection Diagram	32
RF Amplifier	33
Balanced Mixer	34
1650 KHz IF	35
53 KHz IF	36
Audio Amplifier	37
HF Oscillator	38
Second Osc/Divider	39
BFO	40
Overall Circuit Diagram	fold out

SECTION 1

INTRODUCTION

1.1 PURPOSE OF THE EQUIPMENT

The Galaxy FFR 230/6 is a six channel monitor receiver designed for reception of upper sideband, lower sideband and CW signals in the 2 to 18 MHz range. Each channel is crystal controlled for maximum stability in fixed and portable applications. The FFR 230/6 has a unique multiple filter to allow for quick change of bandwidth for optimum performance in receiving USB, LSB and CW signals.

1.2 FUNCTIONAL DESCRIPTION

The Galaxy FFR 230/6 is a dual conversion super hetrodyne receiver which has been designed for the detection of USB, LSB and CW radio signals. Use of solid state technology provides excellent reception under adverse conditions while providing a receiver that is easily maintained in the field. The receiver is light in weight, small in size, produces little heat and operates over a wide temperature range. This compact package mounts in a standard 19 inch relay rack.

1.3 PHYSICAL DESCRIPTION

Size	19" wide, 5 1/4" high, 13 1/4" deep
Weight	18 1/2 lbs.
Front Panel Controls	CLARIFIER, CHANNEL Switch, AF (volume), MODE (USB, LSB, CW) RF Gain, AGC Power ON-OFF
Front Panel Outputs	Head Phone
Rear Panel Outputs	Audio 3.2 ohms and 600 ohms
Rear Panel Inputs	Antenna (50 ohms), Power and Mute
Power Requirements	115 VAC 60 Hz
Remote Control Provisions	External Mute

SECTION 2

SPECIFICATIONS

2.1 PERFORMANCE SPECIFICATIONS

Type of Reception	USB, LSB, CW
Frequency Range	2 to 18 MHz, Crystal controlled
Channels	6 Crystal - controlled
Frequency Stability	±1 PPM 0 to plus 50 degrees centigrade, ±2.5 PPM minus 30 to plus 50 degree centigrade

Sensitivity	Less than 0.5 microvolt for a 10 db signal plus noise to noise ratio.
Selectivity	
USB	2.1 KHz @ 6 db 7.5 KHz @ 60 db
LSB	2.1 KHz @ 6 db 7.5 KHz @ 60 db
CW	1.5 KHz @ 6 db 5.5 KHz @ 60 db
IF Rejection	60 db minimum
Image Rejection	50 db minimum
RF Input Impedance	50 ohms, unbalanced to ground
Front End Protection	15 VRMS open circuit from a 50 ohm generator
Audio Output	3 watts, 3.2 ohms with less than 10% distortion, 1 milliwatt, 600 ohms with less than 10% distortion
Audio Response	Not more than 6 db at 400 and 2500 Hz. Reference to 1000 Hz for USB and LSB
BFO Range	±1200 Hz (CW Mode Only)
CLARIFIER Range	±10 PPM
RF Input Impedance	50 Nominal
AVC	1 Microvolt to .1 volt will cause less than 6 db change in audio output.
Environmental Conditions	Temperature Range -30° to 50° C
Power Input	115 VAC 10% 60 Hz 40 watt

2.2 TRANSISTOR COMPLIMENT

1. 2N1535
2. 2N3414
5. 2N3563
5. 2N4916
5. 2N2926 Yellow
1. 2N3638
1. D42C1
1. D43C1
3. 3N128

2.3 1C Compliment

2. MC890P
1. MC723P

2.4 DIODE AND FUSE COMPLIMENT

8. IN270
1. IN462
7. B5E5
2. 5V Zener
1. 3.6V Zener
1. Fuse MDL-1/2A
1. Fuse AGC 2.5 A

2.5 CRYSTALS

The frequency determining crystals for the first and second oscillators are mounted in a temperature controlled oven assembly for maximum frequency stability. For SSB and CW below 16 MHz

$$fa + fb = fc$$

where

fa = carrier frequency in Hz
fb = 1650000 Hz
fc = HFO crystal frequency in Hz

For SSB and CW above 16 MHz

Calculate the same as above and divide by 3 for the desired crystal frequency.

Note: For USB the "assigned (FCC) frequency" is 1400 Hz above the "carrier frequency".

SECTION 3

INSTALLATION

3.1 UNPACKING

Carefully remove the Galaxy FFR 230/6 from the packing carton. Examine it closely for signs of shipping damage. Remove all hold-down tape and check to insure that all transistors and crystals are properly seated in their sockets. Inspect closely for any signs of internal damage.

Should any shipping damage be apparent -- NOTIFY THE DELIVERING CARRIER IMMEDIATELY! State to the carrier the full extent of the damage and file a claim IMMEDIATELY!

Fill out the enclosed WARRANTY REGISTRATION CARD and mail it TODAY to insure that your warranty will be properly validated.

Save the packing material and the shipping carton. You may need it at a later date for shipment or storage of the receiver.

After you are satisfied that no damage has resulted from shipment, and have removed all tape and insured that all crystals and transistors are properly seated in their sockets, replace the cabinet.

3.2 RACK-MOUNTED INSTALLATION

The FFR 230/6 may be rack mounted in a standard 19" rack panel 5 1/4" high. The rack mounting chassis is provided with standard RETMA spacing on the rack mounting screw notches. See Figure 1.

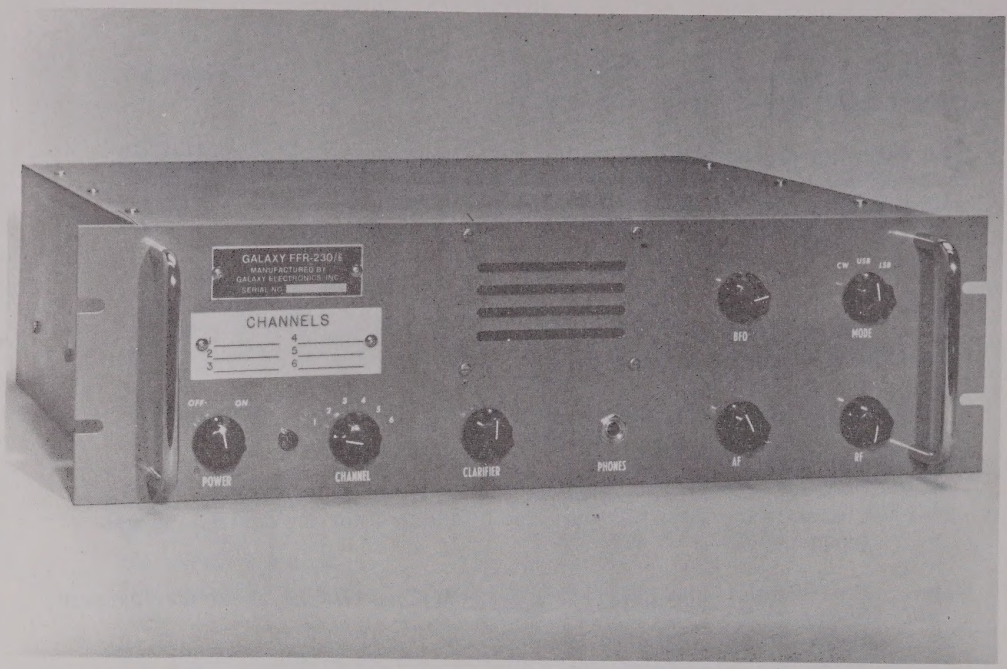


FIGURE 1. FRONT PANEL

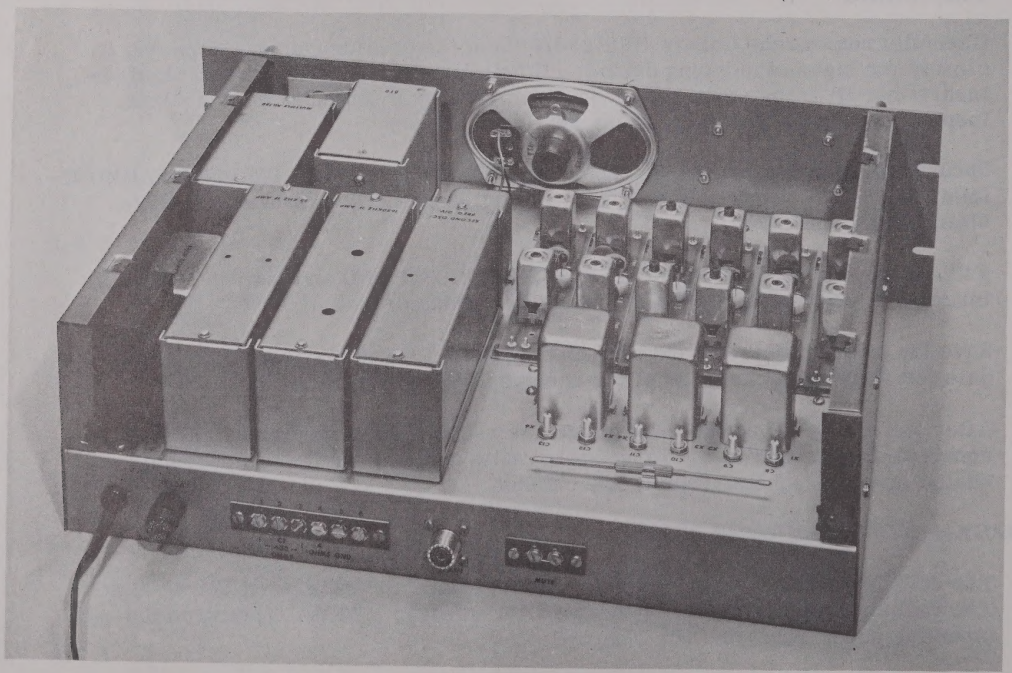


FIGURE 2. REAR PANEL

3.3 POWER REQUIREMENTS

The FFR 230/6 has its own 117 VAC Power Supply built into the unit.

3.4 ANTENNA CONSIDERATIONS

The FFR 230/6 is designed for use with a 50 ohm antenna. Antennas of random length, such as a long wire, or those of unknown impedance will result in degraded performance unless an antenna coupler is employed.

3.5 AUDIO OUTPUT

3.6.1 The 4 ohm output is available on the front and rear panel, terminals 4 and 5 of the FFR 230/6. The front panel connection is a phone jack allowing the use of either high or low impedance headphones. Any good quality 4 ohm speaker can be connected to the 4 ohm output which is capable of 3 watts. The internal speaker should be disabled by disconnecting the green wire when an external speaker is used.

3.6.2 The 600 ohm output available on the rear panel is a center-tapped, ungrounded output for use with standard telephone lines. When using the 600 ohm line, the phone jack on the front panel can be used for monitoring without disrupting the output.

3.6 REMOTE CONTROL

A remote control circuit is provided on the rear panel of the FFR 230/6 for use in muting the receiver. Muting of the FFR 230/6 is accomplished by removing 12 VDC from the 53 KHz IF Amplifier. This may be done by connecting an external switch or set of relay contacts to the MUTE terminals after removing the jumper. (Receiver is muted when switch is open.) The MUTE terminals are located on the rear panel as shown in Figure 2 and are normally shorted.

CAUTION

THE REGULATED 12 VDC APPEARS ON THE MUTE TERMINALS. DO NOT APPLY ANY EXTERNAL VOLTAGES OR GROUND TO THE MUTE TERMINALS.

3.7 ALIGNMENT

The FFR 230/6 is supplied from the factory with the proper crystals and RF Amplifier Boards installed and pre-aligned. No further alignment is required by the customer. If the channel frequency was not specified in the original order, it will be necessary to select and install the required crystal and RF Amplifier Board and to align the receiver as described in the preventive and corrective maintenance section of this manual.

SECTION 4

OPERATION

4.1 EXPLANATION OF CONTROLS

The operating controls for the receiver are located on the front panel and are simplified for ease of operation. They include the following:

AF - This control adjusts the volume of the audio signal to the internal speaker, external speaker, headphones and 600 ohm outputs.

RF - This control in the "pushed in position" disables the internal AVC circuits and permits complete manual gain control of the receiver. When the control is pulled out, the control varies the AVC threshold. Maximum gain is in the CW position.

CHANNEL - This switch selects one of the six pretuned operating frequencies. Each position has its own pretuned RF Amplifier board and pre-aligned crystal.

POWER - This switch applied 117 VAC to the receiver in the "ON" position. The red pilot light next to the switching indicates power is applied to the receiver.

CLARIFIER - This control allows for voice clarification when the mode switch is in the USB or LSB position. For CW operation, this control allows slight adjustment of the CW beat note.

MODE - This switch selects the desired mode of reception. In the USB or LSB position it selects a fixed frequency BFO and a 2.1 KHz filter. In the CW position it selects a 1.5 KHz filter and activates the variable BFO control.

BFO - This control operates in the CW MODE only. It permits the CW beat note to be adjusted to the desired pitch.

4.2 TYPICAL CONTROL SETTINGS

If the receiver was factory equipped with the channel crystals, it was completely aligned and tuned up and will require no further adjustment before placing it in service.

4.2.1 Place the POWER switch in the ON position and allow 15 minutes for the ovens to reach operating temperature.

4.2.2 Select the desired mode of reception.

4.2.3 Pull the RF control out and turn the knob maximum clockwise.

4.2.4 Select the desired mode of reception.

4.2.5 Turn the AF control to a comfortable listening level.

4.2.6 If the mode selected is USB or LSB, adjust the CLARIFIER control for maximum intelligibility.

4.2.7 If the mode selected is CW, adjust the BFO control for the desired pitch.

SECTION 5

THEORY OF OPERATION

5.1 INTRODUCTION

The FFR 230/6 is a completely solid state superheterodyne unit designed to receive both USB, LSB and CW signals within the range of 2 to 18 MHz. This receiver is completely self contained in one unit. Double conversion is used to provide the advantage of extra image rejection and improved receiver selectivity. The intermediate frequencies are 1650 KHz and 53.226 KHz. A four pole switchable LC filter is used to provide a high degree of unwanted sideband suppression while retaining excellent audio quality. Ovens are provided for maximum frequency stability. Refer to the schematic diagram, fold-out in the back of this manual, and the receiver block diagram, while following the receiver circuit description.

5.2 RF AMPLIFIER

There are six individual plug-in RF Amplifier Boards that maybe plugged into the radio. One is selected by the channel switch S1. The incoming signal from the antenna is coupled to Q101 thru T101. The signal is amplified in a differential amplifier, Q101 and Q102, and passes thru another tuned circuit to the output of the RF amplifier E104. AVC voltage is applied to the bases of Q101 and Q102 to reduce gain on strong signals. The signal at E104 is connected to the balanced mixer, J201.

5.3 HIGH FREQUENCY OSCILLATOR

The high frequency oscillator crystal is a type CR-27/U crystal. The crystal is located in a precision oven assembly which controls temperature of the crystal to 75 degrees centegrade. The oscillator is composed of Q701. (This is a special temperature compensated Pierce oscillator circuit.) C7 (CLARIFIER) is a front panel control for signal clarification. C8 to C13 are chassis mounted controls for trimming the crystal oscillator on frequency. Q702 is a common collector buffer stage and the signal is connected from there to the Balanced Mixer, J202.

5.4 BALANCED MIXER

The two input frequencies from the RF Amplifier and the HF Oscillator are mixed in the Balanced Mixer to produce a difference frequency of 1650 KHz. For frequencies between 16 and 18 MHz, the third harmonic of the HFO mixes with the signal from the RF amplifier to produce an IF of 1650 KHz. The output of the mixer is coupled to J203 thru a low pass filter network. The signal at J203 is connected to the 1650 KHz IF Amplifier J301. Switch S1 selects the appropriate crystal, trimmer and the corresponding RF Amplifier Board.

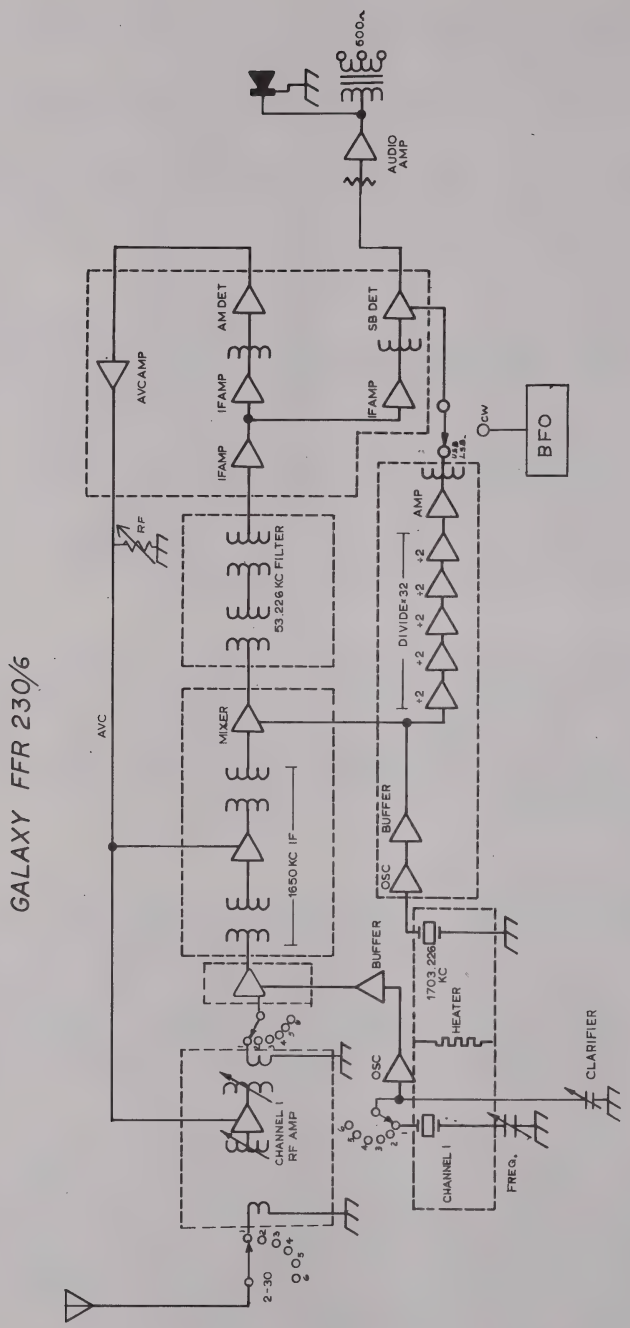


FIGURE 3. BLOCK DIAGRAM

5.5 1650 KHz IF AMPLIFIER

The 1650 KHz signal from the Balanced Mixer is filtered and amplified in Q301 and Q302. These transistors are in a differential amplifier circuit similar to The RF amplifier. AVC is applied to the bases of Q301 and Q302 to limit their gain on strong signals. The 1650 KHz signal is coupled thru T302 to the second mixer, Q303. Also, 1703.226 KHz from the second oscillator is coupled to the second mixer. The output at J303 is 53.226 KHz and is connected to the Multiple Filter, E501.

5.6 OSCILLATOR DIVIDED CIRCUITS

The crystal for this oscillator is also located in a precision oven assembly. It is a type CR-27/U crystal at 1703.226 KHz. It is connected to Q601 which is a standard Pierce oscillator circuit similar to the one used in the HFO. The output of this oscillator is amplified in Q602 and appears on TP601 and J601. A portion of this signal is fed to MC890p integrated circuit divided. This integrated circuit is composed of two JK flip-flops innerconnected to a divide by four circuit. The output of this IC is 425.806 KHz. This signal is fed to a second MC890p which is innerconnected the same as the first MC890p. The output of this IC is 106.451 KHz. This signal is fed to MC723p integrated circuit which is a single JK flip-flop. The output of this flip-flop is 53.226 KHz. This signal is amplified in Q603. The output appears at TP602 and J602. This divider circuit has its voltage supplied from the FUNCTION switch and only operates in the sideband position.

5.7 MULTIPLE FILTER MODULE

This module contains three seperate four pole Chebishev filters. The band widths and the center frequencies of these filters are switched for the different modes of operation. The specifications for these filters are listed in Section 2.1.

5.8 SECOND IF AMPLIFIER

Q401 amplifies the signal from the multiple filter. The output is coupled to IF amplifiers Q402 and Q404. These amplifiers are broadband and require no tuning.

5.9 AVC DETECTOR

The AVC detector is comprised of diodes D401 and D402. They are connected in a standard voltage doubler configuration. The output of this detector is coupled to the AVC circuitry and a low pass filter circuit.

5.10 SIDEBAND DETECTOR

Q403 receives signals from Q402 (IF amp) and J402 (BFO). The audio output from this stage passes thru a low pass filter and is connected to the audio gain control. The BFO signal which came from the oscillator divider module is only present when the function switch is in the sideband position. When the mode switch is in the CW position, the BFO signal is generated in the BFO module.

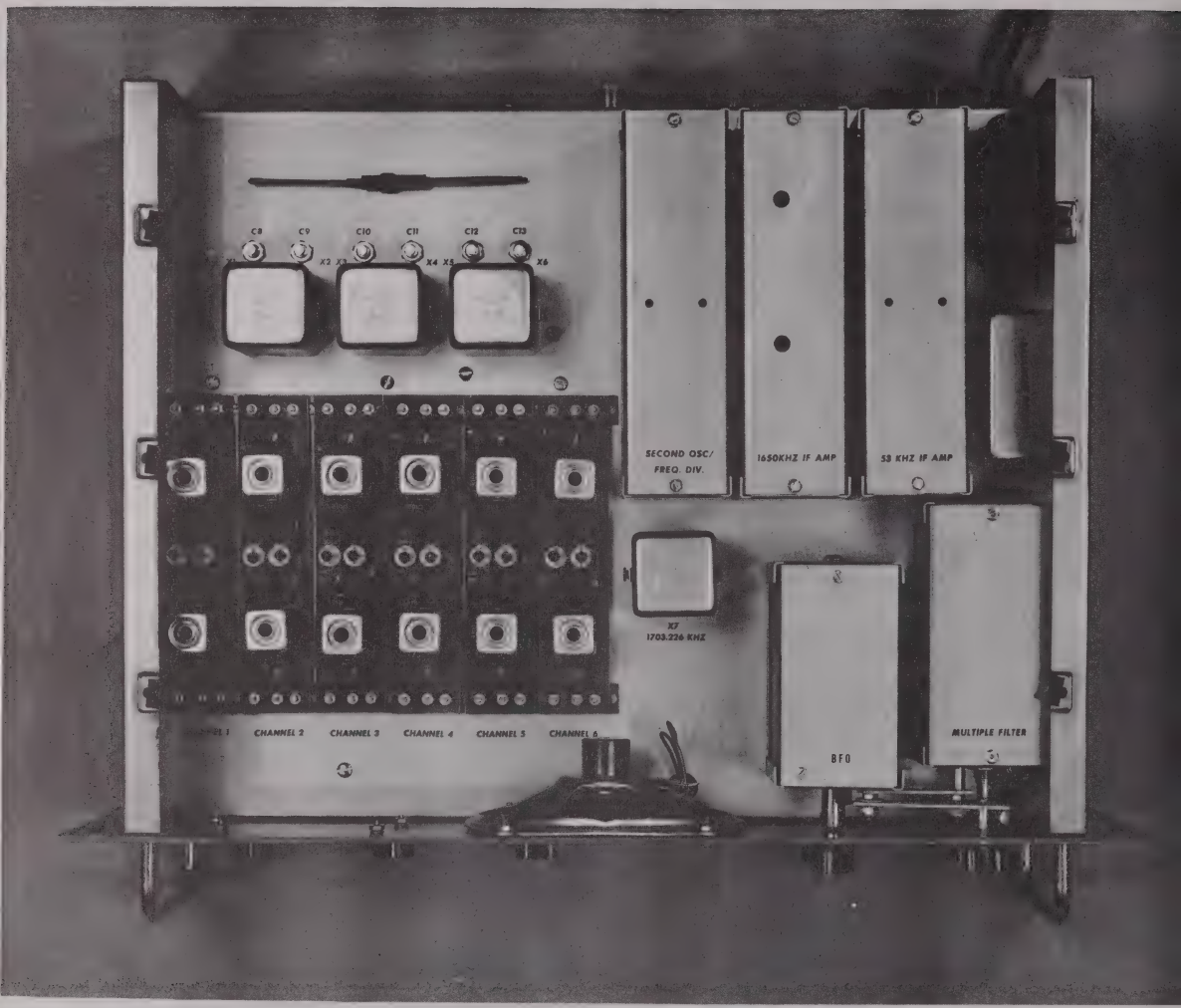


FIGURE 4. TOP VIEW

5.11 AVC AMPLIFIER

Q405 is a DC amplifier which receives its signal from the AVC detector. The output of this amplifier is coupled to 1650 KHz IF amplifier and the RF amplifier transistors.

5.12 BFO MODULE

The BFO Module operates in the CW mode only. Power to this unit is applied when the mode switch is in the CW mode via switch S901. The beat frequency oscillator, Q901, is a standard Hartley design. Components L901, C901, C902 and C904 form the resonant circuit which determines the oscillator output frequency of 52.026 KHz to 54.426 KHz. The BFO's output frequency is adjustable from the front panel control BFO (C904). The output of the BFO is coupled to the base of Q902 which is a common emitter buffer amplifier transistor. The output of Q902 is coupled to switch S901 which connects the BFO to the product detector Q403.

5.13 AUDIO OUTPUT CIRCUITS

The detected audio from the AF control, R10, is amplified by the RC coupled common emitter amplifier Q801. The output of this amplifier passes on to the three stage complimentary output circuit which is comprised of Q802, 803, 804, 805. This DC coupled circuit amplifies the level of the audio signal to 3 watts. This output signal is applied to the 600 ohm output terminals by way of matching transformer T801. The output signal is also applied to the PHONE jack on the front panel, the 4 ohm output terminal (4), and the internal speaker.

5.14 POWER SUPPLY AND REGULATOR CIRCUITS

AC Operation

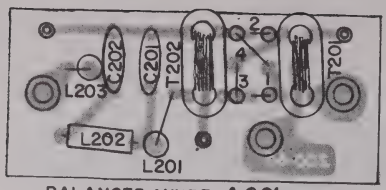
The AC line voltage from the primary power cord is applied thru S2 to transformer T1. The secondary voltage of T1 is rectified by diode D1, D2, D3, and D4. These diodes are connected in a standard full wave bridge circuit. The rectified voltage is filtered by C1 and applied to the series regulator transistor Q1. R6 adjusts the output voltage to 12.2 volts. The primary line is protected by F1. F2 protects the internal supply and regulator.

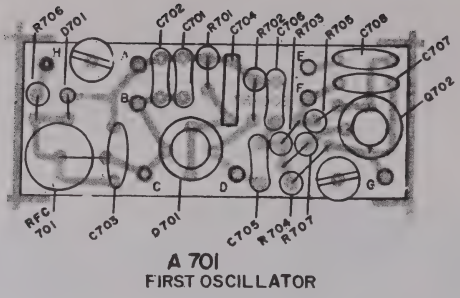
SECTION 6

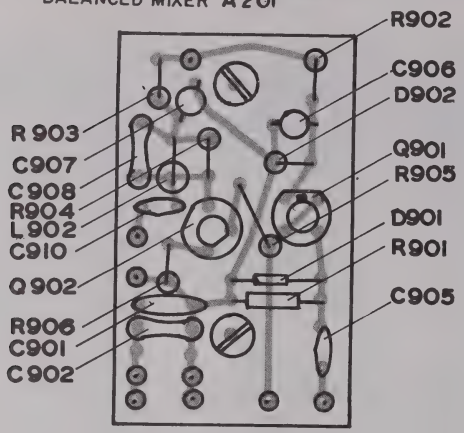
PREVENTIVE AND CORRECTIVE MAINTENANCE

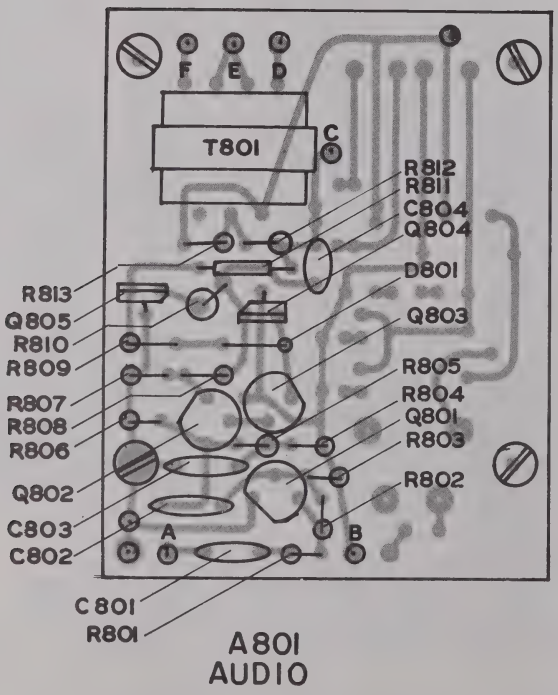
6.1 GENERAL

FFR 230/6 tests and alignment procedures should be performed by qualified personnel only. Any one of the adjustments or tests described in this section may be performed individually, provided the proper test setup and preliminary adjustments are made. All warnings, cautions, and notes applicable to a particular procedure should be strictly followed. If an abnormal indication is obtained during the performance of the procedures, troubleshooting and repair of the circuit under test is indicated. For general trouble shooting procedures, refer to the appropriate drawings and procedures.









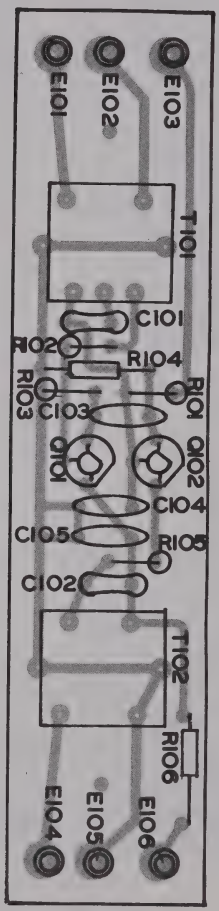
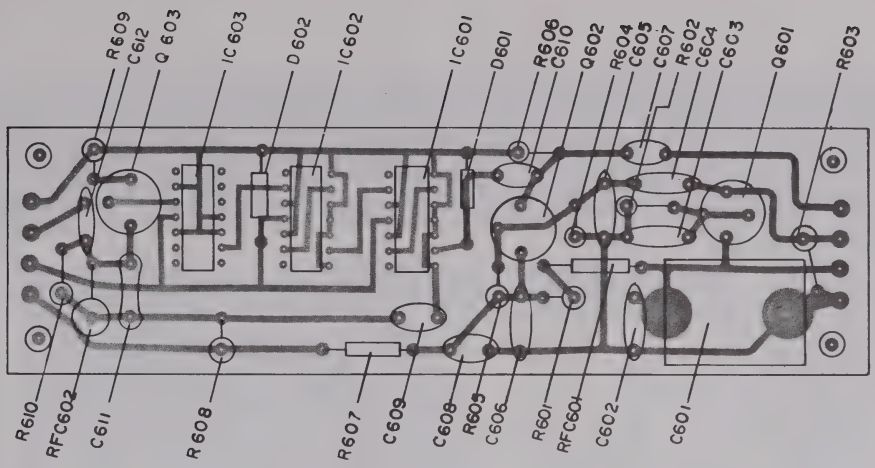
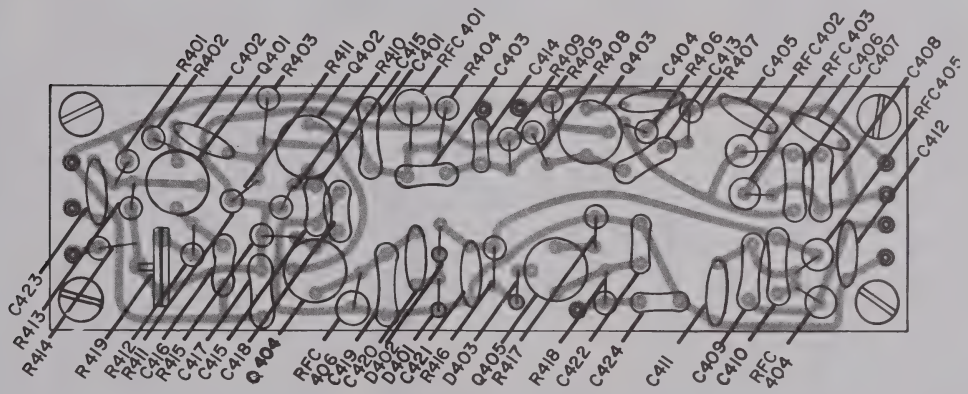


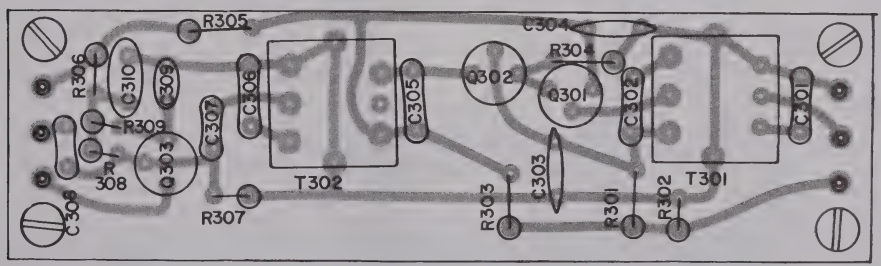
FIGURE 5. PRINTED CIRCUIT BOARDS



A 601 SECOND OSC / DIVIDER



A 401 53 KHZ IF AMP



A 301 1650 KHZ IF

FIGURE 6. PRINTED CIRCUIT BOARDS

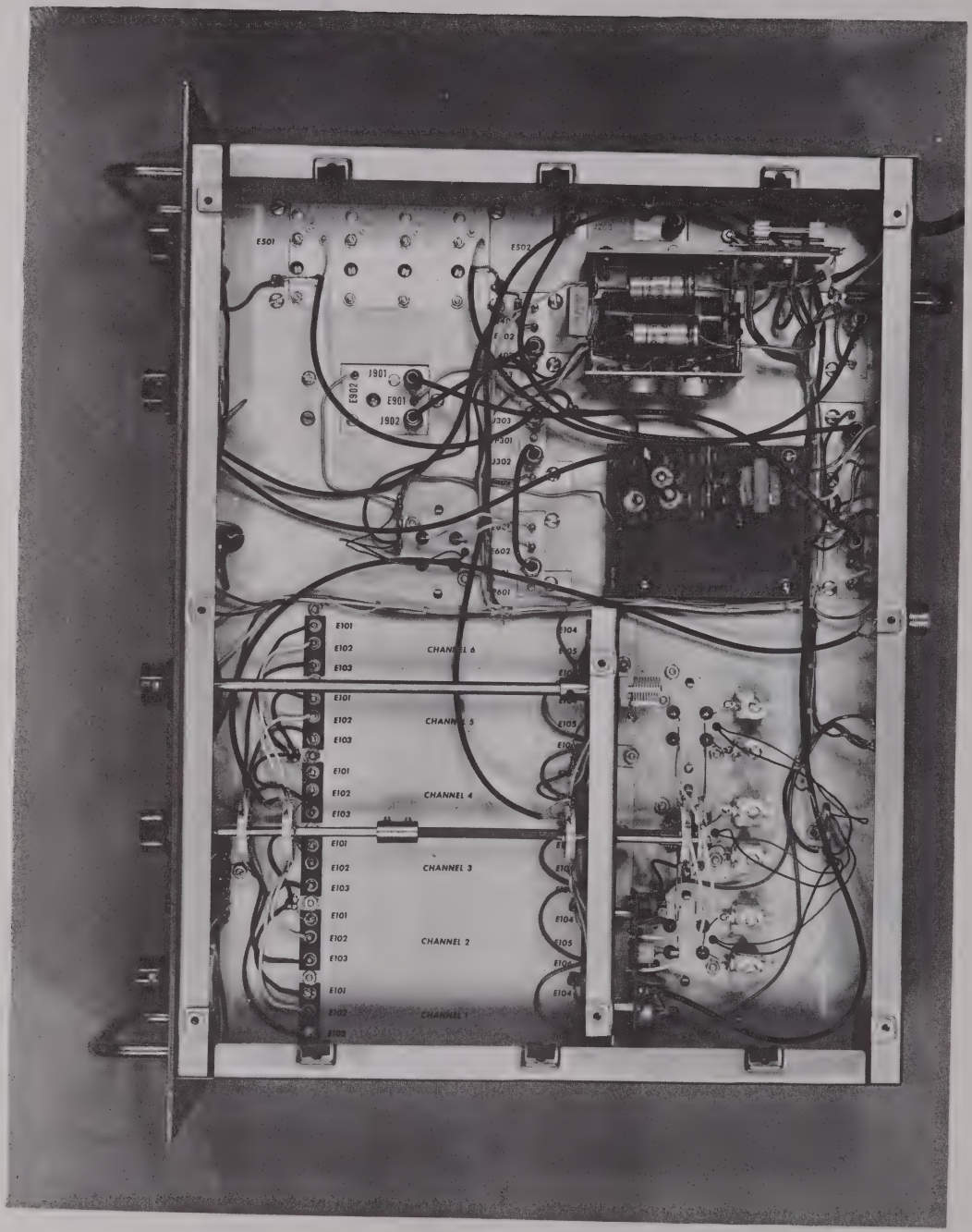


FIGURE 7. BOTTOM VIEW

6.2 TEST EQUIPMENT REQUIRED

Vacuum Tube Voltmeter - Hewlett Packard 410B or equivalent.
Frequency Counter - 5 Hz to 20 MHz.
Radio Frequency Signal Generator - Hewlett Packard 606A or equivalent.
Audio Frequency Generator - Hewlett Packard 200CD or equivalent.
Audio Millivoltmeter - Capable of measuring 50 millivolts, 1000 Hz

6.3 ALIGNMENT

For the following alignment it is assumed that the FFR 230/6 is operable and an output can be heard from the speaker. If not, refer to Trouble Shooting in Section 6.4.

6.3.1 REGULATOR ADJUSTMENT

Set the MODE switch to USB. Connect a voltmeter to terminal B on A801 to monitor the regulator output. Allow the receiver to operate until the ovens cycle as noted by the fluctuation of the regulator output voltage. Adjust R6 for a reading of 12.2 ±.1 volts. Refer to Figures 5 and 7 for location of A801-B and R6.

6.3.2 1703 KHz CRYSTAL OSCILLATOR ADJUSTMENT

Allow 30 minutes warm-up time before adjusting the 1703 KHz oscillator frequency. Remove the Second Oscillator/Frequency Divider module cover. Connect the frequency counter to TP601. Adjust C601 so the counter reads 1703226 Hz ±5 Hz. Refer to Figures 6 and 7 for location of TP601 and C601. Replace the module cover.

6.3.3 BFO OSCILLATOR ADJUSTMENT

Set the FFR 230/6 control as follows:

MODE.....USB
BFO.....Mid-Range
CHANNEL.....Any used channel
RF.....Pull, maximum CW

Connect the signal generator to the ANT jack and set for 1000 uV unmodulated output at the frequency of the channel being used. Adjust the generator frequency for zero beat. Switch the MODE switch to CW position. Adjust L901 for zero beat. L901 is located on the bottom of the BFO module near E901. Refer to Figure 7 for location.

6.3.4 RF AMPLIFIER INSTALLATION AND ALIGNMENT

If the RF Amplifier Boards and channel crystals have already been installed, proceed to Section 6.3.4.2, RF AMPLIFIER ALIGNMENT.

6.3.4.1 RF AMPLIFIER INSTALLATION

The RF Amplifier Board and associated channel crystal is available as a seperate Frequency Kit on special order. Refer to the parts list for A101-2 to 4 MHz, A101 - 4 to 8 MHz, A101 - 8 to 16 MHz or A101 - 14 to 16 MHz for appropriate part numbers. The boards may be identified as to frequency range by comparing the variable components - T101, T102, C101 and C102 - with the parts list.

Install the RF Amplifier Board at the appropriate channel position. Refer to Figure 4 for location. Remove the appropriate crystal oven cover and carefully lift the heater assembly off the existing crystals if any. The crystal positions are identified on the top chassis screening as X1 thru X6, corresponding to the channel number. Install the channel crystal in the appropriate socket. Replace the heater assembly and oven cover.

6.3.4.2 RF AMPLIFIER ALIGNMENT

Set the FFR 230/6 controls as follows:

MODE ..... USB
RF ..... Pull, maximum CW
CLARIFIER .... Mid-range
AF ..... Comfortable level

Connect a DC VTVM (+3V range) to terminal 6 on the rear panel terminal strip. The AVC voltage is available at terminal 6 for monitoring during alignment. Connect the signal generator to the ANT jack and set the frequency for the desired channel. Adjust the generator level for approximately 2 volts AVC.

Adjust T101 and T102 for minimum AVC voltage, reducing the generator level as required to maintain approximately 2 volts AVC. Refer to Figure 5 for location of T101 and T102.

Repeat for all used channels.

6.3.5 HIGH FREQUENCY CRYSTAL OSCILLATOR ADJUSTMENT

Allow 30 minutes warm-up time before adjusting the HF crystal oscillator frequency. Set the CLARIFIER Control to mid-range. Disconnect P202 from J202 and connect the frequency counter to P202. Connect a grounding jumper from P202-shield to the chassis. Determine the correct crystal frequency for each channel being adjusted from Section 2.5. Adjust the indicated capacitor until the counter reads the correct frequency ±5 Hz.

CHANNEL	ADJUST
1	C8
2	C9
3	C10
4	C11
5	C12
6	C13

Replace P202 to J202. Refer to Figure 3 and 7 for location of J202 and C8 thru C13.

Note: The above procedure adjusts the FFR 230/6 to the exact channel frequency. System netting is normally accomplished by means of the CLARIFIER or BFO control.

6.3.6 1650 KHz IF ALIGNMENT

Set the FFR 230/6 controls as follows:

MODE.....USB
RF .....Pull, maximum CW
CLARIFIER.....Mid-range
AF.....Comfortable level

Connect a DC VTVM (+ 3V range) to terminal 6 on the rear panel terminal strip. The AVC voltage is available at terminal 6 for monitoring during alignment. Connect the signal generator to the ANT jack and set the frequency for the desired channel. Adjust the generator level for approximately 2 volts AVC. Adjust top and bottom cores in T301 and T302 for minimum AVC voltage, reducing the generator output as required to maintain approximately 2 volts AVC. Refer to Figure 6 for location of T301 and T302.

6.4 TROUBLE SHOOTING

This paragraph contains general information about basic characteristics to aid service personnel in isolating circuit malfunctions and repairing the receiver. It has been our experience that the following systematic steps be followed to locate a receiver malfunction.

6.4.1 VISUAL INSPECTION

6.4.1.1 Check the front panel controls to determine if the receiver is properly tuned for the mode of operation.

6.4.1.2 Inspect the cables and connectors on the rear of the receiver and make certain that they are in place.

6.4.1.3 Remove bottom covers and inspect the top and bottom of the receiver for shorts, broken wires, or broken parts.

6.4.2 RECEIVER CONTROL SETTINGS

Pre-set the FFR 230/6 controls as follows:

CHANNEL..... To a used channel
MODE ..... USB
RF ..... Pull, maximum CW

6.4.3 MODULE DC AND AC VOLTAGES

With the aid of Figures 5 and 7, the following table of voltages should be checked. These measurements are made with the MODE switch in the USB position and no signal applied to the receiver. These checks should be made with a suitable VTVM (410B).

TERMINAL	USE	VOLTAGE
E103*	RF AVC	3 VDC
E106*	RF Amplifier	11.5 VDC
E301	IF AVC	3 VDC
E302	1650 KHz IF	11.5 VDC
E404	50 KHz IF	11.5 VDC
E603	1703 KHz Osc	11.5 VDC
E604	Divider	3.6 VDC
A701-G	HFO	11.5 VDC
A701-H	HFO	11.5 VDC
A801-B	Audio	12.2 VDC
TP601	Osc Output	.8 VAC
TP602	Divider Output	8 VAC
R705 (top)	HFO Output	.25 VAC

* Must be measured on the RF Amplifier Board associated with the CHANNEL Switch position.

6.4.4 MALFUNCTION ISOLATION BY SIGNAL SUBSTITUTION

6.4.4.1 AUDIO CHECK

With the aid of Figure 7, perform the following check. Set the AF control maximum CCW. Temporarily disconnect the jumper on the rear panel MUTE terminals. Connect a 600 ohm termination and an AC voltmeter across the 600 ohm output terminals 1 and 3. Connect an audio generator to E401. Adjust the generator for 1000 Hz, 50 millivolts RMS output. Advance the AF control until the meter reads 1 volt. If unable to obtain this output with AF control maximum CW, trouble shoot the audio board A801.

Replace the MUTE terminals jumper.

6.4.4.2 RF CIRCUIT CHECK

With the aid of Figure 7, the following procedure should be followed. The following sections may be checked by signal substitution at various module inputs, starting at the 50 KHz IF Module and progressing back to the antenna. The generator used should have a 50 ohm source impedance and you should pre-set all receiver controls as in 6.4.2. Connect

a DCVTVM (+3V range) to terminal 6 on the rear panel terminal strip. Connect the generator to the following jacks on the frequency indicated. Advance the output control of the generator slowly until the AVC voltage begins to decrease.

CAUTION

115 VAC IS PRESENT ON THE F1 FUSE HOLDER. DISCONNECT THE POWER CORD FROM THE LINE WHILE MAKING CONNECTIONS TO J401.

Connect Generator To	Generator Frequency	Typical Generator Voltage
J401	53.226 KHz	150 uV
J302	53.226 KHz	100 uV
J301	1650 KHz	2 uV
J201	Channel Frequency	10 uV
J1	Channel Frequency	1-2 uV

When a point is found that requires considerably more signal than indicated, the trouble is between this point and the last check point. Note: Before proceeding further, check the coaxial cables with an ohm meter for a possible open or shorted condition.

6.4.5 TRANSISTOR VOLTAGE CHECKS

The following table of voltages may be used to further isolate a problem after it has been localized to particular module or section of the receiver. The measurements were taken with a Hewlett Packard 410B VTVM. Refer to Figures 5, 6, 8 and the individual module schematic diagrams. Be certain that proper basing is observed when installing all semi-conductors.

TRANSISTOR DC VOLTAGES

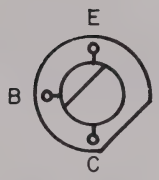
FFR 230/6

	Emitter	Base	Collector
Q1	21.2	21	12.2
Q2	6.5	7.1	21
Q101	2.3	3	11.5
Q102	2.3	3	11
Q301	2.3	3	11.5
Q302	2.3	3	11.5
Q303	9.6	8.9	0
Q401	8.8	8.1	.58
Q402	8.6	7.9	.15
Q403	8.9	8.7	.9
Q404	8.6	7.9	.15
Q405	0	.12	3
Q602	5	5.6	11
Q603	.4 (Note 1)	.8	11
Q702	4	4.7	11.5
Q801	0	.6	5
Q802	.5	1.1	11.5
Q803	12.2	11.5	7.5
Q804	7	7.5	12.2
Q805	7	6.5	0
Q902	.25 (Note 2)	0	4
	Source	**Gate**	**Drain**
Q601	1.2	0	5.8
Q701	1.3	0	5.3
Q901	(Note 2)		

Integrated Circuits (Note 1)

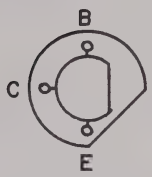
IC 601	1, 3, 4, 5, 7, 10, 12	0
	2	.4
	6, 9, 13	.8
	11	3.6
IC 602	1, 3, 4, 5, 7, 10, 12	0
	2	.8
	6, 9, 13	.8
	11	3.6
IC 603	3, 4, 9, 12	0
	2, 10	.8
	11	3.6

Note 1 - MODE switch in USB position
Note 2 - MODE switch in CW position

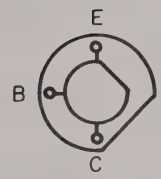


TOP VIEW
Q 2
Q 405
Q 602
Q 603
Q 902

TOP VIEW
IC 601
IC 602
IC 603

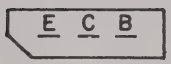


TOP VIEW
Q 801
Q 802

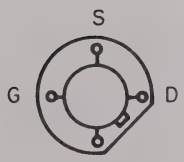


TOP VIEW

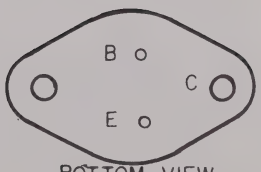
Q 101	Q 401
Q 102	Q 402
Q 301	Q 403
Q 302	Q 404
Q 303	Q 702
	Q 803



BOTTOM VIEW
Q 804
Q 805



TOP VIEW
Q 601
Q 701
Q 901



BOTTOM VIEW
Q 1

FIGURE 8. SEMICONDUCTOR BASING DIAGRAM

SECTION 7

WARRANTY

Not withstanding any contract provisions, GALAXY ELECTRONICS guarantees to remedy any defect in material or workmanship existing in the FFR 230/6 at no cost to the owner, exclusive of shipping charges, provided:

- That the defect is not caused by improper installation or use contrary to our instruction.
- That the unit serial number has been registered with us by the original purchaser.
- That the equipment or part that appears defective is delivered to us or the authorized repair station, we may designate for examination.
- That this examination, in our judgement, discloses a defective part or workmanship.

This warranty applies to labor and all semi-conductor devices for a period of 90 days. All other parts for a period of one year from the date of purchase by the original owner. This warranty applies only to the original purchaser and is not transferable. This warranty does not cover any transportation costs that may be incurred, and our sole liability is repair of any defect, for the period stated above.

No person is authorized to assume for us any other liability in connection with the sale of this or other of our products.

GALAXY ELECTRONICS reserves the right to make any change that is necessary or desirable by us to the product, without advance notice, or incurring any obligation to make like changes or improvements in units previously manufactured or sold.

All warranty expressed here are void and terminated one year after the last FFR 230/6 receiver has been manufactured by us.

SERVICE INFORMATION

WARRANTY PARTS REPLACEMENT:

If any component in the FFR 230/6 should fall during warranty period and a replacement part is needed, please mail the defective part, with a letter of instruction to GALAXY ELECTRONICS, Customer Service Department. On receipt of this defective component a new part will be sent to you immediately.

RETURNING EQUIPMENT FOR SERVICE:

Do not ship equipment to GALAXY ELECTRONICS without prior written permission. We prefer to send special shipping labels to avoid delay of unexpected shipments. If time is extremely important, it is better to wire or call us for approval and we will rush shipping labels to you. When a shipment is expected, even the time of sending labels to you is less than that loss when an unexpected shipment is received.

It is very important that the shipment be well packed and fully insured. Damage claims must be settled between you and the carrier and it will greatly delay any returns. Proper packing normally avoids this trouble.

All returns should be made in our standard cartons only -- so save your carton when unpacking your unit.

All correspondence relating to warranty service, warranty parts replacement, parts orders, or other service should be directed:

GALAXY ELECTRONICS INC.
a subsidiary of
HY-GAIN ELECTRONICS CORP.
Rural Route 3
Lincoln, Nebraska 68505

Attention: Galaxy Customer Service Department.

SECTION 8

PARTS LIST

MAIN CHASSIS

Symbol	Galaxy Part No.	Description	Mfg.	Mfg. Part No.
C1	721797	2000 uF, 25V Electrolytic	Whale	BR-2000-25
C2	721820	1000 uF, 16V Electrolytic	Amperex	C437AR/E1000
C3		Same as C2		
C4		Not Used		
C5		Not Used		
C6	721550	.01 uF gmv 600V Ceramic	RMC	BG-01 GMV
C7	721847	2 to 34 pf Air Variable	E. F. Johnson	193-0010-001
C8		Same as C7		
C9		Same as C7		
C10		Same as C7		
C11		Same as C7		
C12		Same as C7		
C13		Same as C7		
D1	760285	Diode, 400 PIV 1A	Edal	B5E5
D2		Same as D1		
D3		Same as D1		
D4		Same as D1		
D6		Same as D1		
D7		Same as D1		
D5	760298	Zener Diode, 5V 1W 5%	Schauer	SZ5.0 (A)
DS1	710213	Pilot Lamp	Eldema	BG90-RC-NE2E
F1	710005	Fuse, 1/2A Slo Blow	Bussman	MDL-1/2
XF1	710202	Fuseholder, F1	Bussman	HKPCC
F2	710230	Fuse, 2 1/2A	Bussman	AGC 2 1/2
XF2	710206	Fuseholder, F2	H.H. Smith	531
HR1	690282	Oven, Crystal	Northern	EC-62
HR2		Same as HR1		
HR3		Same as HR1		
HR4		Same as HR1		
J1	680206	ANT Connector, SO239	Ava Electronic	SO239
J2	650207	Phone Jack	Switchcraft	12A
Q1	760262	Transistor, 2N1535	Motorola	2N1535
Q2		Transistor, 2N3414	General Electric	2N3414
XQ2	640225	Socket, Q2	Augat	8058-45G1
R1	721281	1.5K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R5		Same as R1		
R2	721305	330 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R3	721306	47 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R4	721285	100 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R6	721491	3K Ohms Variable 2W	CTS	112-3000
R7	721385	10 Ohms 10% 1W	IRC	GBT-1 10%
R8	721311	4.7K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R9	721503	50 Ohms 10% 5W	IRC	PW5
R10	721488	5K Ohms Variable Comp.	CTS	T450-2D
R11	722173	100K Ohms Variable, SPST Switch	Stackpole	722173 (13-54)
R12	721310	68K Ohms 10% 1/2W	IRC	GBT-1/2 10%
S1	700306	Switch, Channel	CTS	212-A28907-5
S2	700221	Switch, Power	CTS	222-A13126-1
T1	730259	Power Transformer	American Magnetics	AM 5779
X7	780047	Quartz Crystal 1703.226 KHz	M-tron	CR22A/U 1703.226
Z1	870576	Multiple Filter, 53 KHz	Hy-Gain	870576
Miscellaneous				
	600221	Power Cord	Phalco Corp.	M-1077
	730249	Speaker, 3.2 Ohms	McGregor	789101-5

Symbol	Galaxy Part No.	Description	Mfg.	Mfg. Part No.
	450276	Alignment Tool	Gen. Cement	8606
	450294	Channel Frequency Plate	Hy-Gain	450294
	700296	Knobs	Kurz Kasch	S-648-3L
	660229	Terminal Strip, 6 Screw	NTT Corp.	2406
	660228	Terminal Strip, 2 screw	NTT Corp.	2402
		RF AMPLIFIER 2 TO 4 MHz		
A101	870592	Circuit Board, Complete	Hy-Gain	870592
C101	721694	180 pF 5% 500V dsm	Sangamo	D155F181
C102		Same as C101		
C103	721550	.01 uF gmv 600V Ceramic	RMC	BF-01 GMV
C104		Same as C103		
C105		Same as C103		
Q101	721629	Transistor 2N3563	Fairchild	2N3563
Q102		Same as Q101		
XQ101-2	640234	Socket, Q101 and Q102	Alcon	51-3003N
R101	721313	1K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R102	721306	47 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R103	721308	2.2K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R104		Same as R103		
R105	721316	470 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R106	721285	100 Ohms 10% 1/2W	IRC	GBT-1/2 10%
T101	722196	Transformer, 2 to 4 MHz	Hy-Gain	722196
T102	722197	Transformer, 2 to 4 MHz	Hy-Gain	722197
X1 to 6	780013	Crystal, Special Order CR27/U	M-tron	CR-27 A/U
PCB 101	750258	Circuit Board, Drilled and Plated	Hy-Gain	750258
		RF AMPLIFIER 4 TO 8 MHz		
A101	870593	Circuit Board, Complete	Hy-Gain	870593
C101	721689	130 pF 5% 500V dsm	Sangamo	D155F131
C102		Same as C101		
C103	721550	.01 uF gmv 600V Ceramic	RMC	BF-01 GMV
C104		Same as C103		
C105		Same as C103		
Q101	721629	Transistor 2N3563	Fairchild	2N3563
Q102		Same as Q101		
XQ101-2	640234	Socket, Q101 and Q102	Alcon	51-3003N
R101	721313	1K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R102	721306	47 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R103	721308	2.2K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R104		Same as R103		
R105	721316	470 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R106	721285	100 Ohms 10% 1/2W	IRC	GBT-1/2 10%
T101	722198	Transformer, 4 to 8 MHz	Hy-Gain	722198
T102	722199	Transformer, 4 to 8 MHz	Hy-Gain	722199
X1 to 6	780013	Crystal, Special Order CR27/U	M-tron	CR-27 A/U
PCB101	750258	Circuit Board, Drilled and Plated	Hy-Gain	750258
		RF AMPLIFIER 8 TO 16 MHz		
A101	870594	Circuit Board, Complete	Hy-Gain	870594
C101	721617	50 pF 5% 500V NPO	RMC	CG50pF NPO 5%
C102		Same as C101		
C103	721550	.01 uF gmv 600V Ceramic	RMC	BG-01 GMV
C104		Same as C103		
C105		Same as C103		

Symbol	Galaxy Part No.	Description	Mfg.	Mfg. Part No.
Q101	721629	Transistor 2N3563	Fairchild	2N3563
Q102		Same as Q101		
XQ101-2	640234	Socket, Q101 and Q102	Alcon	51-3003N
R101	721313	1K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R102	721306	47 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R103	721308	2.2K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R104		Same as R103		
R105	721316	470 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R106	721285	100 Ohms 10% 1/2W	IRC	GBT-1/2 10%
T101	722200	Transformer, 8 to 18 MHz	Hy-Gain	722200
T102	722201	Transformer, 8 to 18 MHz	Hy-Gain	722201
X1 to 6	780013	Crystal, Special Order CR 27/U	M-tron	CR-27 A/U
PCB101	750258	Circuit Board, Drilled and Plated	Hy-Gain	750258

RF AMPLIFIER 14 TO 18 MHz

A101	870595	Circuit Board, Complete	Hy-Gain	870595
C101	721629	39 pF 5% 500V NPO	RMC	CG39pF NPO 5%
C102		Same as C101		
C103	721550	.01 uF gmv 600V Ceramic	RMC	BF-01 GMV
C104		Same as C103		
C105		Same as C103		
Q101	721629	Transistor 2N3563	Fairchild	2N3563
Q102		Same as Q101		
XQ101-2	640234	Socket, Q101 and Q102	Alcon	51-3003N
R101	721313	1K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R102	721306	47 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R103	721308	2.2K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R104		Same as R103		
R105	721316	470 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R106	721285	100 Ohms 10% 1/2W	IRC	GBT-1/2 10%
T101	722200	Transformer, 8 to 18 MHz	Hy-Gain	722200
T102	722201	Transformer, 8 to 18 MHz	Hy-Gain	722201
X1 to 6	780013	Crystal, Special Order CR27/U	M-tron	CR-27 A/U
PCB101	750258	Circuit Board, Drilled and Plated	Hy-Gain	750258

BALANCED MIXER MODULE

A200	870508	Module, Complete	Hy-Gain	870508
A201	870508CB	Circuit Board, Complete	Hy-Gain	870508CB
C201	721634	.002 uF 10% 500V Ceramic	RMC	JE .002 10% 5YE
C202		Same as C201		
D201	760293	Diode, IN270	ITT	IN270
D202		Same as D201		
D203		Same as D201		
D204		Same as D201		
J201	650206	Phone Jack	NTT Corp.	341
J202		Same as J201		
J203		Same as J201		
L201	721942	8.2 uH Molded Choke	Jeffers	4445-1K
L203		Same as L201		
L202	721929	15 uH Molded Choke	Jeffers	4445-4K
P201	650233	Phone Plug	NTT Corp.	39D-AL
P202		Same as P201		
P203		Same as P201		
T201	722146	Transformer	Hy-Gain	722146

Symbol	Galaxy Part No.	Description	Mfg.	Mfg. Part No.
T202		Same as T201		
PCB201	750105	Circuit Board, Drilled and Plated	Hy-Gain	750105
		1650 KHz IF MODULE		
A300	870510	Module, Complete	Hy-Gain	870510
A301	870510CB	Circuit Board, Complete	Hy-Gain	870510CB
C301	721656	820 pF 5% 500V dsm	Sangamo	D195F821
C302		Same as C301		
C305		Same as C301		
C306		Same as C301		
C303	721583	.02 uF+80-20% 50V Ceramic	RMC	BT .02+80-20%
C304		Same as C303		
C307	721703	470 pF 5% 500V dsm	Sangamo	D155F471
C308	721663	100 pF 5% 500V dsm	Sangamo	D155F101
C309	721878	10 uF 20V Tantalum	Kemet	T360B106MO-20AS
C310	721879	100 uF 20V Tantalum	Kemet	T360D107MO-20AS
J301	650206	Phone Jack	NTT Corp.	341
J302		Same as J301		
J303		Same as J301		
P301	650233	Phone Plug	NTT Corp.	39D-AL
P302		Same as P301		
P303		Same as P301		
Q301	760253	Transistor, 2N3563	Fairchild	2N3563
Q302		Same as Q301		
Q303	760269	Transistor, 2N4916	Fairchild	2N4916
XQ301-3	640234	Socket, Q301 thru 303	Alcon	51-3003N
R301	721313	1K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R304		Same as R301		
R309		Same as R301		
R302	721310	68K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R303	721291	47K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R305	721285	100 Ohms	IRC	GBT-1/2 10%
R306		Same as R305		
R307	721343	12K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R308	721311	4.7K Ohms 10% 1/2W	IRC	GBT-1/2 10%
RFC301	721916	1 mH, Molded Choke	Jeffers	1331-35J
T301	722160	Transformer, 1650 KHz	Hy-Gain	722160
T302	722161	Transformer, 1650 KHz	Hy-Gain	722161
PCB301	750102	Circuit Board, Drilled and Plated	Hy-Gain	750102
		53 KHz IF MODULE		
A400	870511	Module, Complete	Hy-Gain	870511
A401	870511CB	Circuit Board, Complete	Hy-Gain	870511CB
C401	721656	820 pF 5% 500V dsm	Sangamo	D195F821
C407		Same as C401		
C408		Same as C401		
C409		Same as C401		
C410		Same as C401		
C419		Same as C401		
C402	721550	.01 uF gmv 600V Ceramic	RMC	BG-01 GMV
C420		Same as C402		
C423		Same as C402		
C403	721633	18 pF 5% 500V NPO Ceramic	RMC	CG 18NPO 5%
C404	721634	.002 uF 10% 500V Ceramic	RMC	JE .002 10% 5YE
C405		Same as C404		
C406		Same as C404		
C411		Same as C404		

Symbol	Galaxy Part No.	Description	Mfg.	Mfg. Part No.
C412		Same as C404		
C421		Same as C404		
C413	721879	100 uF 20V Tantalum	Kemet	T360D107MO20AS
C417		Same as C413		
C414	721617	50 pF 5% 500V NPO Ceramic	RMC	CG50pF NPO 5%
C415	721878	10 uF 20V Tantalum	Kemet	T360B106MO20AS
C416		Same as C415		
C418		Same as C415		
C422	721880	47 uF 20V Tantalum	Kemet	T360C476MO20AS
C424		Same as C422		
D401	760293	Diode, IN270	ITT	IN270
D402		Same as D401		
D403	760288	Diode, IN462	Fairchild	IN462
J401	650206	Phone Jack	NTT Corp.	341
J402		Same as J401		
P401	650233	Phone Plug	NTT Corp	39D-AL
P402		Same as P401		
Q401	760269	Transistor, 2N4916	Fairchild	2N4916
Q402		Same as Q401		
Q403		Same as Q401		
Q404		Same as Q401		
Q405	760251	Transistor, 2N3414	G.E.	2N3414
XQ401-5	640234	Socket, Q401 thru 405	Alcon	51-3003N
R401	721343	12K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R403		Same as R401		
R402	721305	330 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R404	721340	15K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R405	721339	18K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R406	721318	10K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R407	721320	220 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R412		Same as R407		
R408	721293	6.8K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R409	721311	4.7K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R411		Same as R409		
R413		Same as R409		
R410	721313	1K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R415		Same as R410		
R414	721285	100 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R417		Same as R414		
R418		Same as R414		
R416	721292	2.7K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R419	721475	5K Ohms, Variable	CTS	X-201-2RS
RFC401	721937	10 mH Molded Choke	Jeffers	1313-30J
RFC402		Same as RFC 401		
RFC403		Same as RFC 401		
RFC404		Same as RFC 401		
RFC405		Same as RFC 401		
RFC406		Same as RFC 401		
PCB401	750100	Circuit Board, Drilled and Plated	Hy-Gain	750100

SECOND OSC/FREQ DIVIDER MODULE

A600	870509	Module, Complete	Hy-Gain	870509
A601	870509CB	Circuit Board, Complete	Hy-Gain	870509CB
C601	721854	2-54 pF Air Variable	E.F.Johnson	194-0018-005
C602	721627	30 pF 5% 500V NPO	RMC	CG30pF NPO 5%
C603	721574	.1 uF 20% 200V Film	Amperex	C280AE/P100K
C604	721682	68 pF 5% 500V dsm	Sangamo	D155F680
C605	721665	220 pF 5% 500V dsm	Sangamo	D155F221
C606	721550	.01 uF gmv 600V Ceramic	RMC	BG-01 GMV
C607	721560	.001 uF 10% 1000V Ceramic	RMC	JG-001 10%
C612		Same as C607		
C608	721878	10 uF 20V Tantalum	Kemet	T360B106M020AS
C609		Same as C608		
C610	721559	100 pF 10% Ceramic	RMC	JG-100 10%
C611	721656	820 pF 5% 500V dsm	Sangamo	D195F821
D601	760293	Diode, IN270	ITT	IN270
D602	760305	Zener Diode, 3.6V 1W	Schauer	SZ3.6(A)

Symbol	Galaxy Part No.	Description	Mfg.	Mfg. Part No.
IC601	760279	MC890P	Motorola	MC890P
IC602		Same as IC601		
IC603	760280	MC723P	Motorola	MC723P
J601	650206	Phone Jack	NTT Corp	341
J602		Same as J601		
P601	650233	Phone Plug	NTT Corp.	39D-AL
P602		Same as P601		
Q601	760278	Mosfet, 3N128	RCA	3N128
Q602	760239	Transistor, 2N2926Y	G. E.	2N2926 Yellow
Q603		Same as Q602		
XQ601	640235	Socket, Q601	Alcon	51-4002N
XQ602-3	640234	Socket, Q602 and 603	Alcon	51-3003N
R601	721311	4.7K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R602	721313	1K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R606		Same as R602		
R608		Same as R602		
R603	721309	100K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R604	721343	12K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R605	721318	10K Ohms 10% 1/2W	IRC	GBT 1/2 10%
R607	721285	100 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R609	721316	470 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R610	721340	15K Ohms 10% 1/2W	IRC	GBT-1/2 10%
RFC601	721916	1 mH Molded Choke	Jeffers	1331-35J
RFC602	721937	10 mH Molded Choke	Jeffers	1313-30J
PCB601	750104	Circuit Board, Drilled and Plated	Hy-Gain	750104

HIGH FREQUENCY OSCILLATOR CIRCUIT BOARD

A701	870513	Circuit Board, Complete	Hy-Gain	870513
C701	721640	12 pF 5% 500V N750 Ceramic	RMC	CG-12N750 5%
C702		Not used		
C703	721550	.01 uF gmv 600V Ceramic	RMC	BG-01 GMV
C707		Same as C703		
C708		Same as C703		
C704	721574	.1 uF 20% 200V Film	Amperex	C280AE/P100K
C705	721631	56 pF 5% NPO Ceramic	RMC	CG-56NPO 5%
C706	721698	500 pF 5% 500V dsm	Sangamo	D155F501
D701	760298	Zener Diode, 5V 5% 1W	Schauer	SZ5.0 (A)
Q701	760278	Mosfet, 3N128	RCA	3N128
Q702	760253	Transistor, 2N3563	Fairchild	2N3563
XQ701	640235	Socket, Q701	Alcon	51-4002N
XQ702	640234	Socket, Q702	Alcon	51-3003N
R701	721313	1K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R702	721309	100K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R703	721284	22K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R704		Same as R703		
R705	721334	820 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R706	721330	180 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R707	721306	47 Ohms 10% 1/2W	IRC	GBT-1/2 10%
RFC701	721906	350 uH Choke	Antran	AN617
PCB701	750103	Circuit Board, Drilled and Plated	Hy-Gain	750103

AUDIO CIRCUIT BOARD

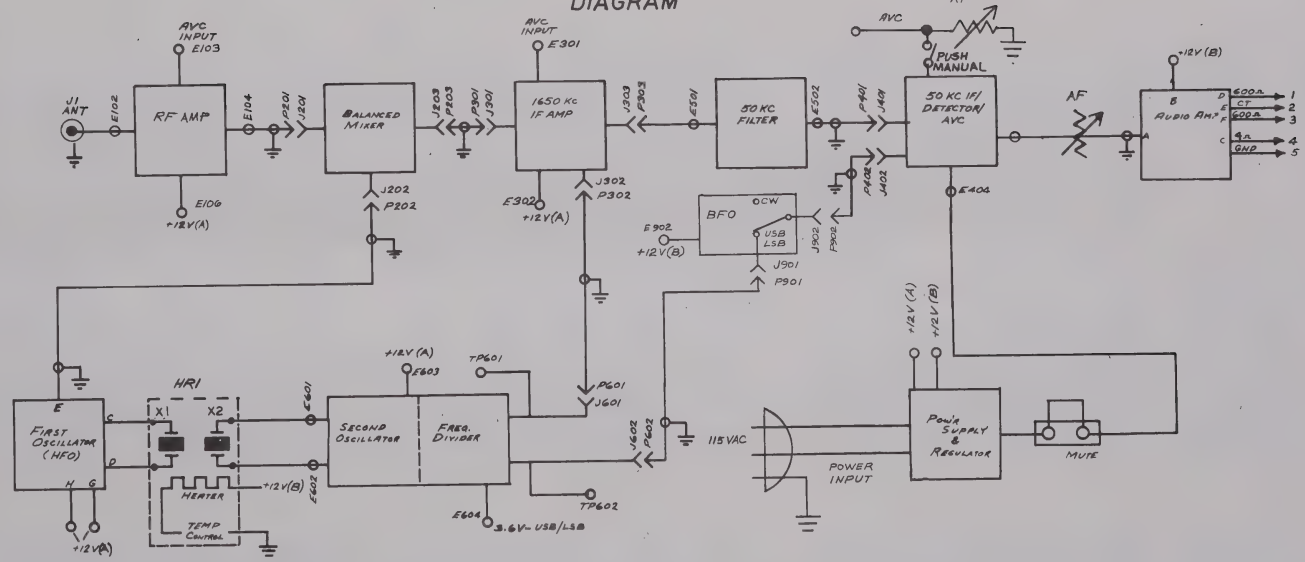
A801	870575	Circuit Board, Complete	Hy-Gain	870575
C801	721550	.01 uF gmv 600V Ceramic	RMC	BG-01 GMV
C802	721574	.1 uF 20% 200V Film	Amperex	C280AE/P100K
C803		Same as C802		
C804	722175	220 uF 10V Tantalum	Kemet	T360D227M010AS

Symbol	Galaxy Part No.	Description	Mfg.	Mfg. Part No.
D801	760285	Diode, 400 PIV 1A	Edal Ind.	B5E5
Q801	760239	Transistor, 2N2926Y	GE	2N2926 Yellow
Q802		Same as Q801		
Q803	760244	Transistor, 2N3638	Fairchild	2N3638
Q804	760275	Transistor, D42C1	GE	D42C1
Q805	760276	Transistor, D43C1	GE	D43C1
XQ801-3	640234	Socket, Q801 thru 803	Alcon	51-2003N
R801	721310	68K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R802	721288	1M Ohms 10% 1/2W	IRC	GBT-1/2 10%
R803	721318	10K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R804	721283	150K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R805		Same as R804		
R806	721292	27K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R807	721314	150 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R808	721308	2.2K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R809	721304	12 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R810	721386	1 Ohm 10% 1W	IRC	BWH-1 10%
R811	721327	270 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R812	721359	33 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R813	721315	10 Ohms 10% 1/2W	IRC	GBT-1/2 10%
T801	730213	Line Transformer, 600 Ohm	Am. Magnetics	AM4027
PCB801	750256	Circuit Board, Drilled and Plated	Hy-Gain	750256

BFO MODULE

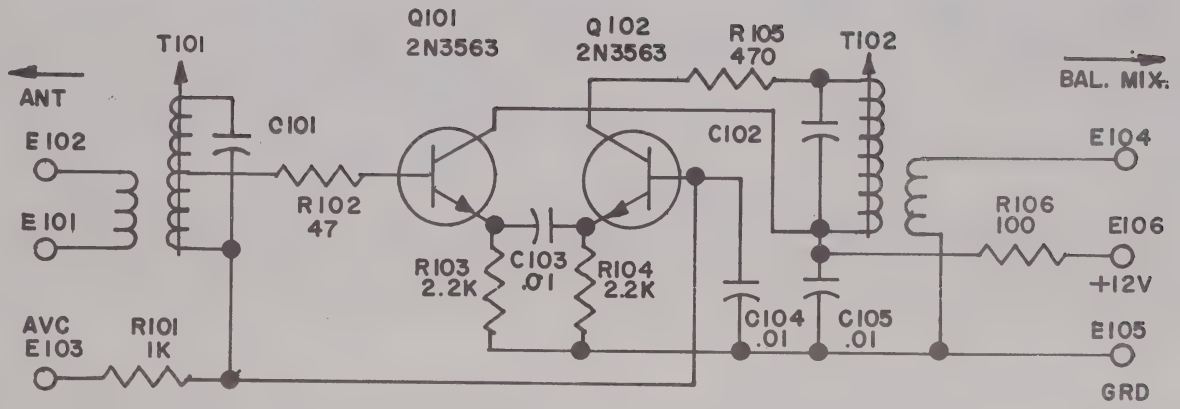
A900	870577	Module, Complete	Hy-Gain	870577
A901	870577CB	Circuit Board, Complete	Hy-Gain	870577CB
C901	721600	330 pF 5% 500V N750	Erie	815000-U2J0-331J
C902	721751	3300 pF 1% 100V dsm	Sangamo	D195F332
C903		Not Used		
C904	722174	365 pF Air Variable	Jackson Bros.	5250/1-25-39
C905	721560	.001 uF 10% 500V Ceramic	RMC	JG-001 10%
C910		Same as C905		
C906	721878	10 uF 20V Tantalum	Kemet	T360B106M020AS
C907		Same as C906		
C908	721656	820 pF 5% 500V dsm	Sangamo	D195F821
D901	760293	Diode, IN270	ITT	IN270
D902	760298	Zener diode, 5V 5% 1W	Schauer	SZ5.0 (A)
J901	650206	Phone jack	NTT Corp.	341
J902		Same as J901		
L901	722195	Coil, BFO Osc.	Hy-Gain	722195
L902	721937	10 mH Molded Choke	Jeffers	1313-30J
P901	650233	Phone Plug	NTT Corp.	39D-AL
P902		Same as P901		
Q901	760278	Mosfet, 3N128	RCA	3N128
Q902	760239	Transistor, 2N2926Y	GE	2N2926 Yellow
XQ901	640235	Socket, Q901	Alcon	51-4002N
XQ902	640234	Socket, Q902	Alcon	51-3003N
R901	721284	22K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R902	721320	220 Ohms 10% 1/2W	IRC	GBT-1/2 10%
R903	721313	1K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R904	721340	15K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R905	721318	10K Ohms 10% 1/2W	IRC	GBT-1/2 10%
R906	721316	470 Ohms 10% 1/2W	IRC	GBT-1/2 10%
S901	700307	Slide switch DPDT Spring Rtn.	UID Electronics	SW-322-SR-D
PCB901	750257	Circuit Board, Drilled and Plated	Hy-Gain	750257

GALAXY FFR 230/6 MODULE INTER-CONNECTION DIAGRAM

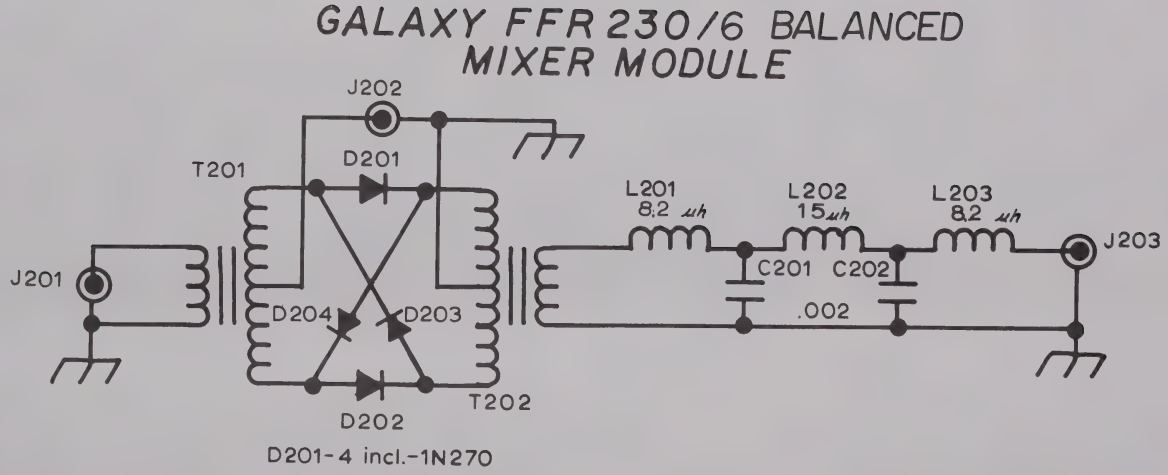


GALAXAY FFR 230/6
RF AMPLIFIER

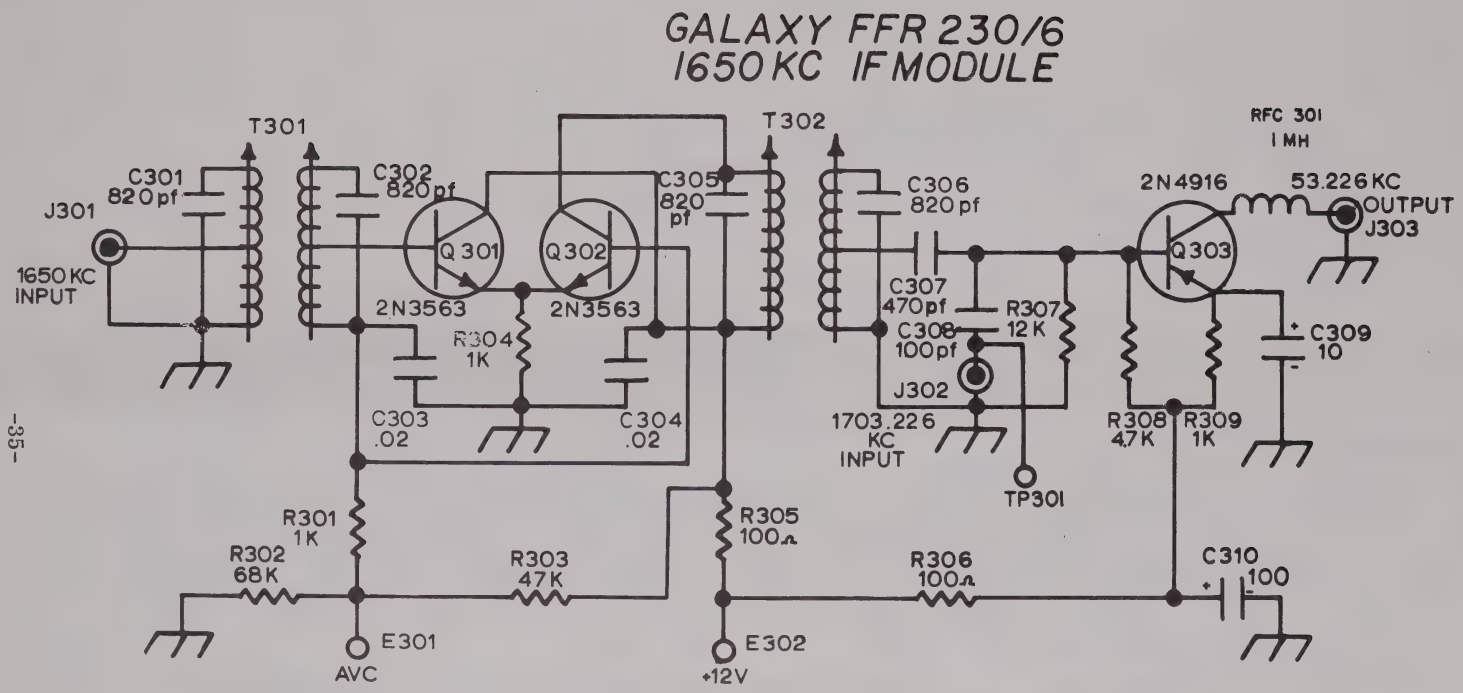
FREQ. RANGE	PRODUCT NUMBER	T101	C101	T102	C102
2–4 MHz	861	722196	180 PF	722197	180 PF
4–8 MHz	862	722198	130 PF	722199	130 PF
8–16 MHz	863	722200	50 PF	722201	50 PF
14–18 MHz	864	722200	39 PF	722201	39 PF



RF AMPLIFIER CIRCUIT DIAGRAM

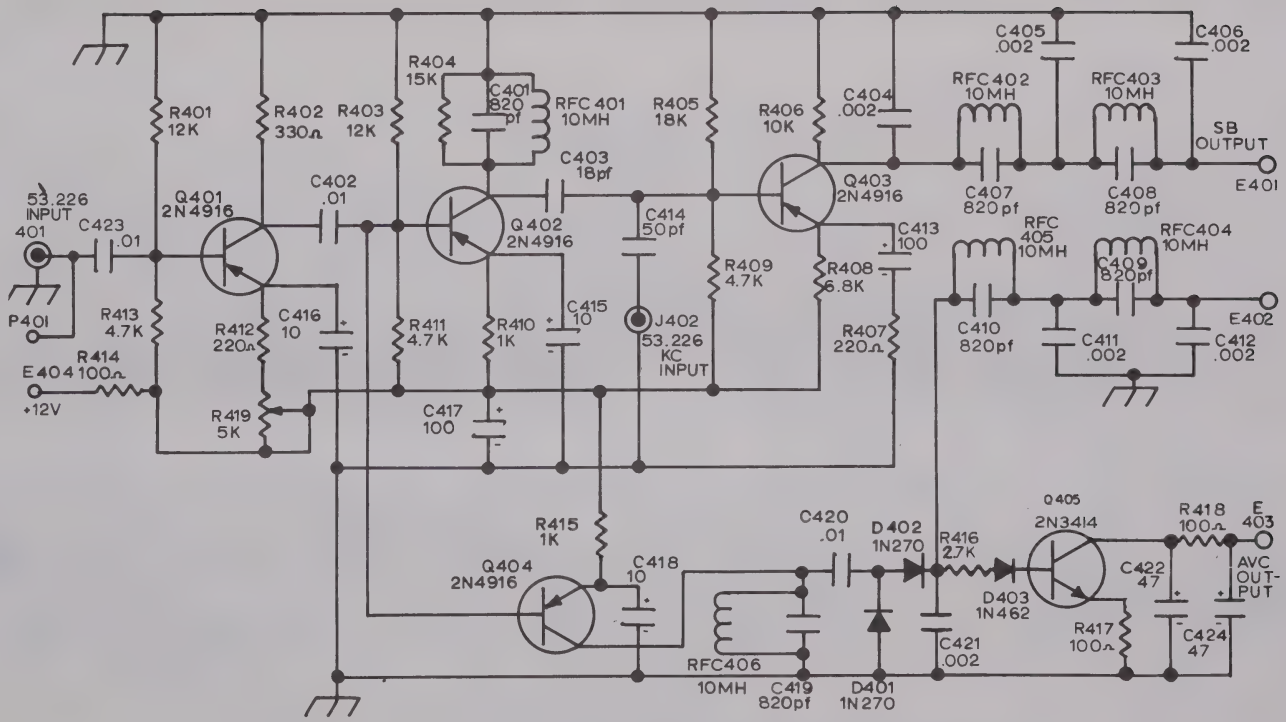


BALANCED MIXER CIRCUIT DIAGRAM



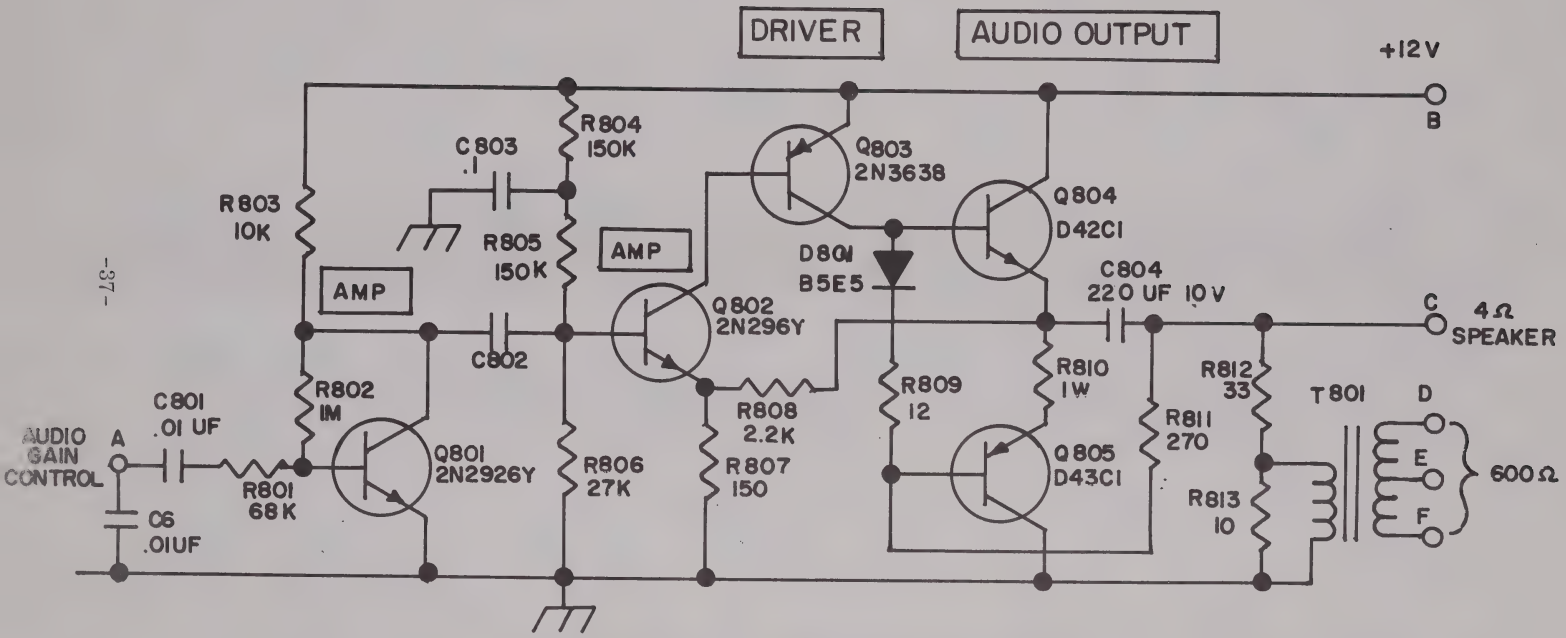
1650 KHz IF CIRCUIT DIAGRAM

GALAXY FFR 230/6 53KC IF AMP./ DETECTOR/AVC



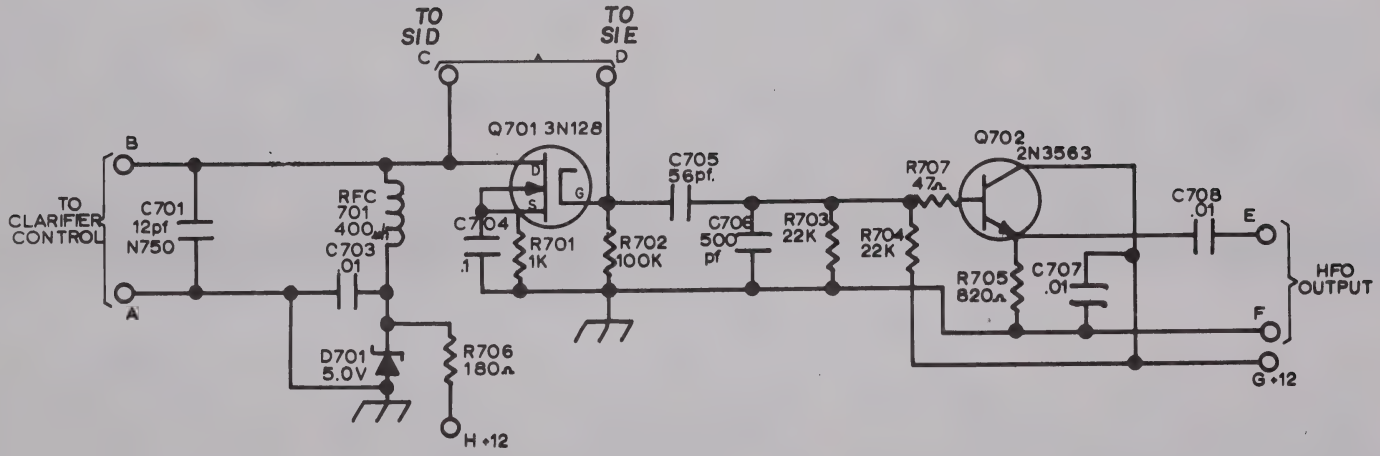
53 KHz IF CIRCUIT DIAGRAM

GALAXY FFR230/6 AUDIO AMP



AUDIO AMPLIFIER CIRCUIT DIAGRAM

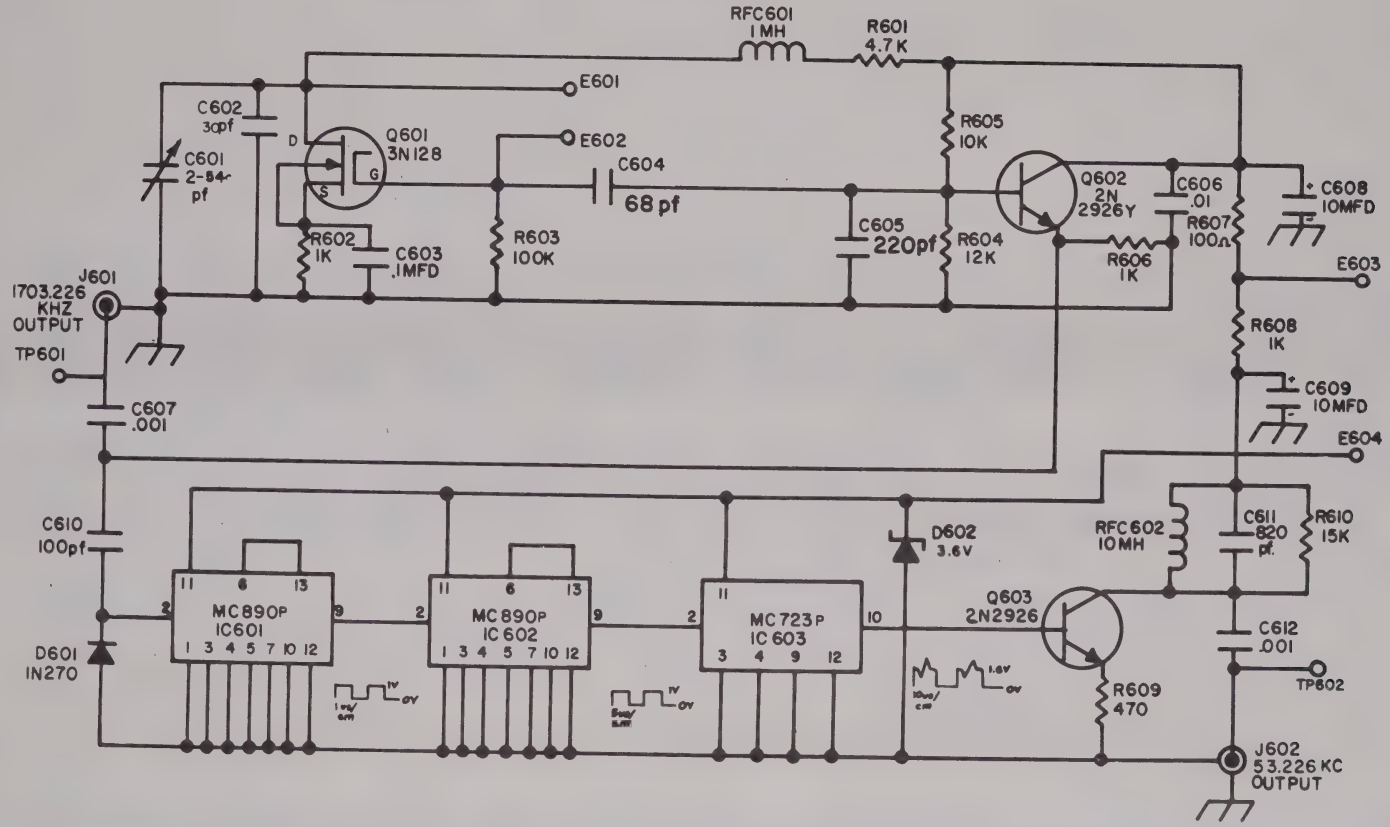
GALAXY FFR 230/6
FIRST OSCILLATOR (HFO)



CAP. VALUES ARE MFD UNLESS NOTED

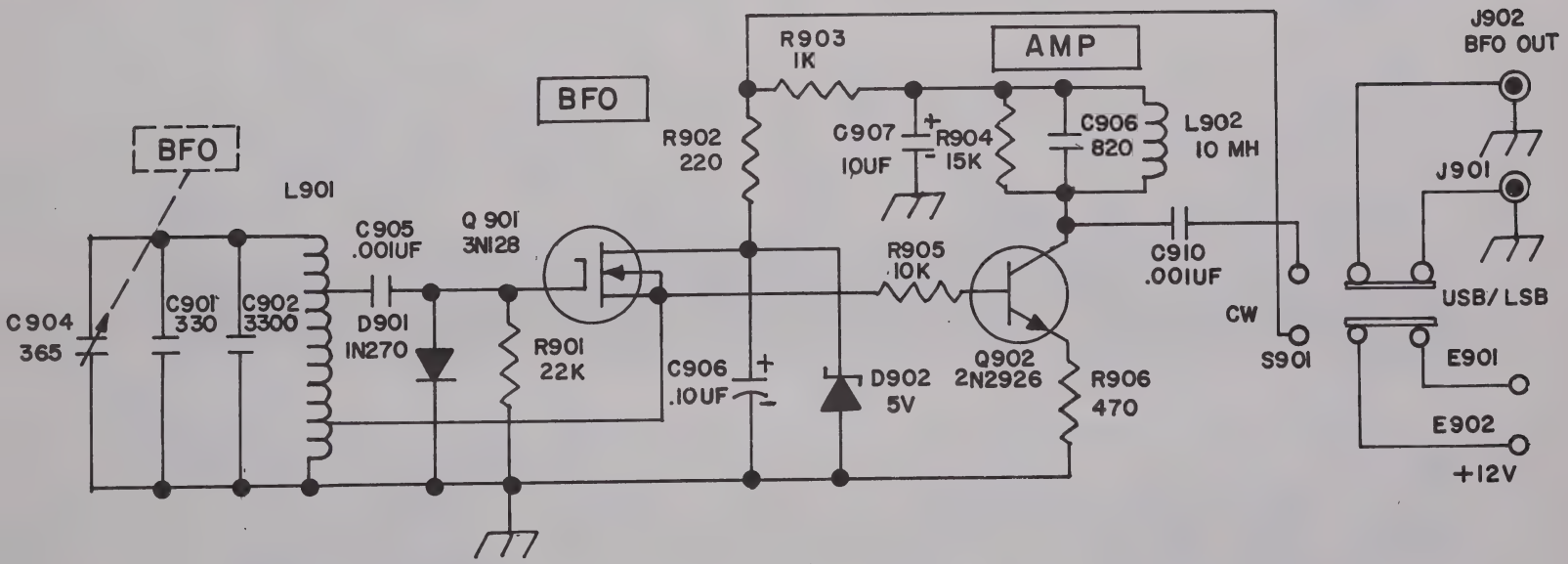
FIRST OSCILLATOR CIRCUIT DIAGRAM

GALAXY FFR230/6 SECOND OSCILLATOR FREQUENCY DIVIDER MODULE



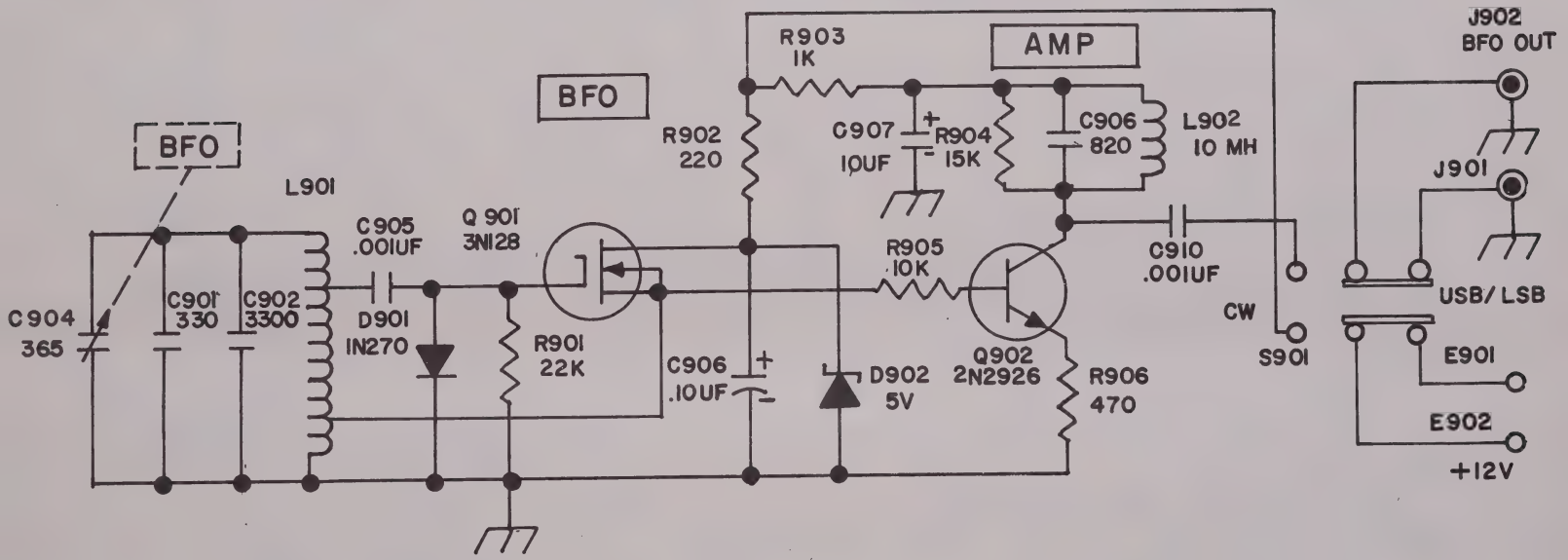
SECOND OSCILLATOR/DIVIDER CIRCUIT DIAGRAM

GALAXY FFR 230/6
VARIABLE BFO MODULE

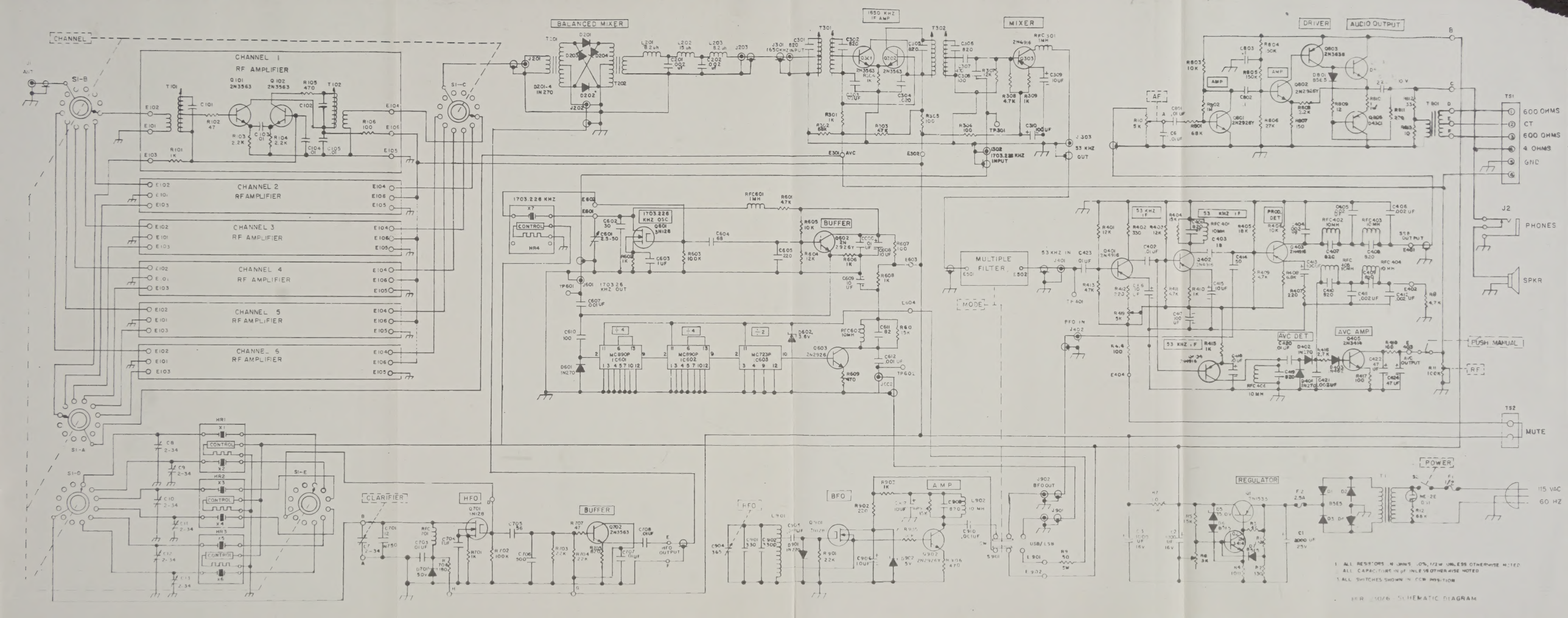


BFO CIRCUIT DIAGRAM

GALAXY FFR 230/6
VARIABLE BFO MODULE



BFO CIRCUIT DIAGRAM


CHANNEL
CHANNEL 1
RF AMPLIFIER
CHANNEL 2
RF AMPLIFIER
CHANNEL 3
RF AMPLIFIER
CHANNEL 4
RF AMPLIFIER
CHANNEL 5
RF AMPLIFIER
CHANNEL 6
RF AMPLIFIER
BALANCED MIXER
1650 KHZ
IF AMP
MIXER
DRIVER
AUDIO OUTPUT
AF
AMP
BUFFER
MULTIPLE
FILTER
MODE
53 KHZ IF
PROD. DET
AVC DET
AVC AMP
PUSH MANUAL
RF
CLARIFIER
HFO
BFO
REGULATOR
POWER
600 OHMS
CT
600 OHMS
4 OHMS
GND
PHONES
SPKR
MUTE
115 VAC
60 HZ
53 KHZ OUT
53 KHZ IN
HFO OUTPUT
BFO OUT
1703.226 KHZ OSC
1703.226 KHZ OUT
1650 KHZ IF INPUT
1703.226 KHZ INPUT
ALL RESISTORS IN OHMS ,05%,1/2W UNLESS OTHERWISE NOTED
ALL CAPACITANCE IN μF UNLESS OTHERWISE NOTED
ALL SWITCHES SHOWN IN CCW POSITION
HR-10/6 SCHEMATIC DIAGRAM